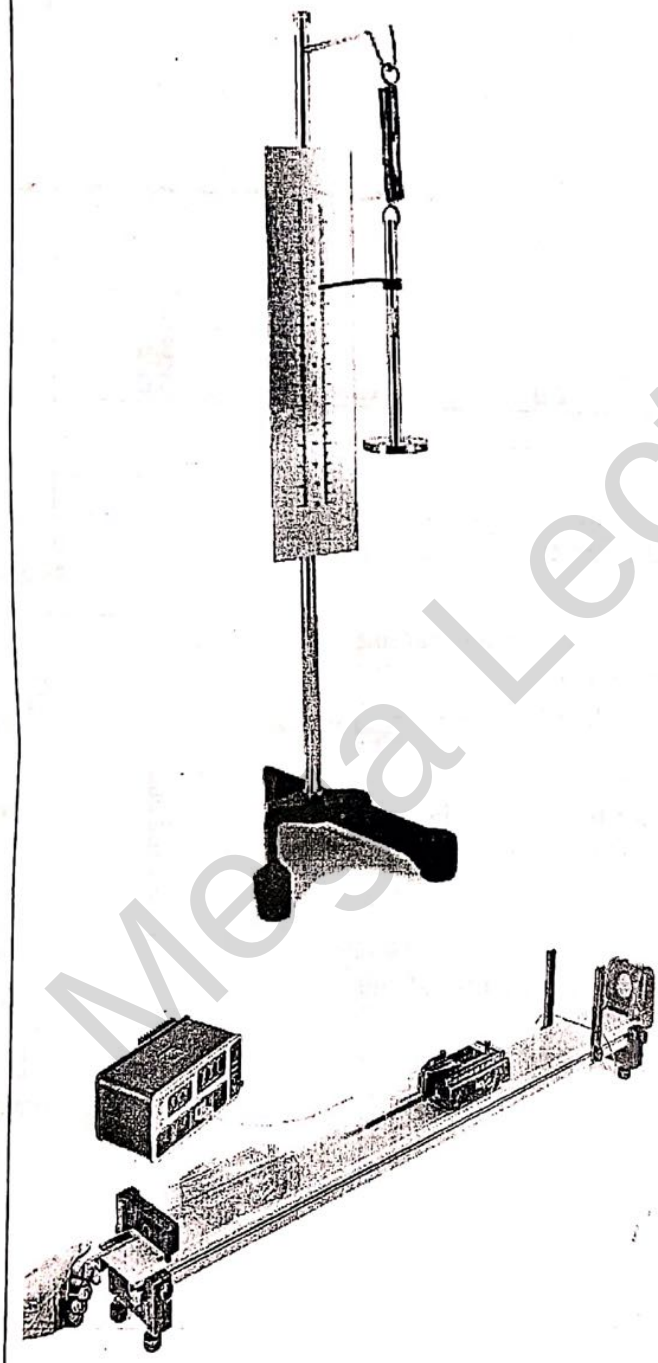
O Level Physics Syllabus Content for CAIE 2019-22 Exams

CHAPTER 6: DEFORMATION



Syllabus Content

6.1 Elastic deformation

Learning outcomes
Candidates should be able to:

a) State that a force may produce a change in size and shape of a body.
b) *Plot, draw and interpret extension-load graphs for an elastic solid and describe the associated experimental procedure.
c) *Recognise the significance of the term "limit of proportionality" for an elastic solid (an understanding of the elastic limit is not required).
d) Calculate extensions for an elastic solid using proportionality.

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DEFORMATION

Definition

Elasticity is the ability of a substance to recover its original shape and size after deformation.

The extension produced is a spring is the difference between the stretched length and original

Experiment:

Relation between Load and Extension:

Mass m/kg	Load L/N	Scale reading / mm	Extension /mm
0.0	0.0	9.0	0.0
0.1	1.0	12.0	3.0
0.2	2.0	15.0	6.0
.	.	.	.
.	.	.	.
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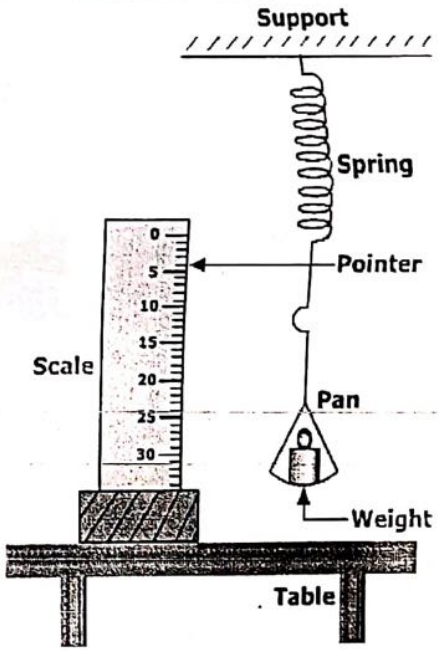
1. In the apparatus shown, take the scale reading when the pas is empty (no load)
2. Add 100g mss (equal 1 N) to the pan and record the new scale reading then record the extension.
3. Repeat step 2 several times to increase the load gradually and record the extension on produced each time.

Precautions;

i. To get accurate readings, fix a pointer at the lower end of the spring.
ii. Repeat taking all the reading again while unloading the spring.

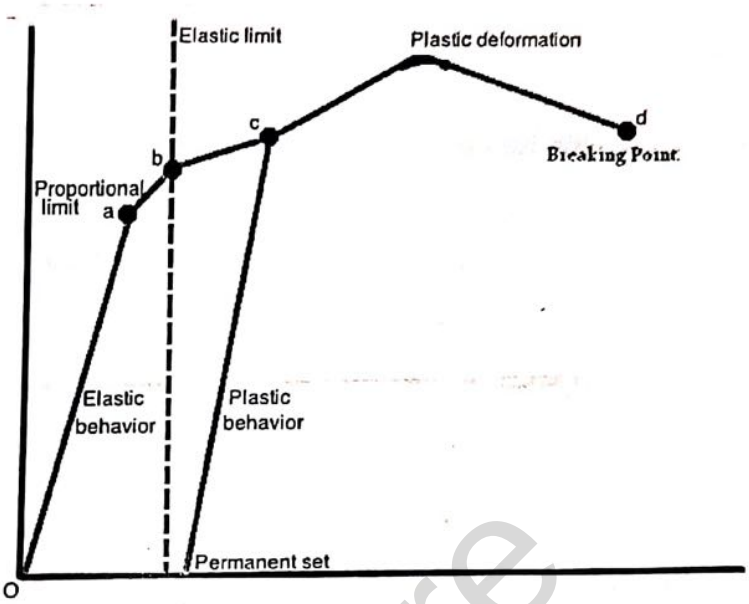
4. Plot the relation between the lad and the extension.



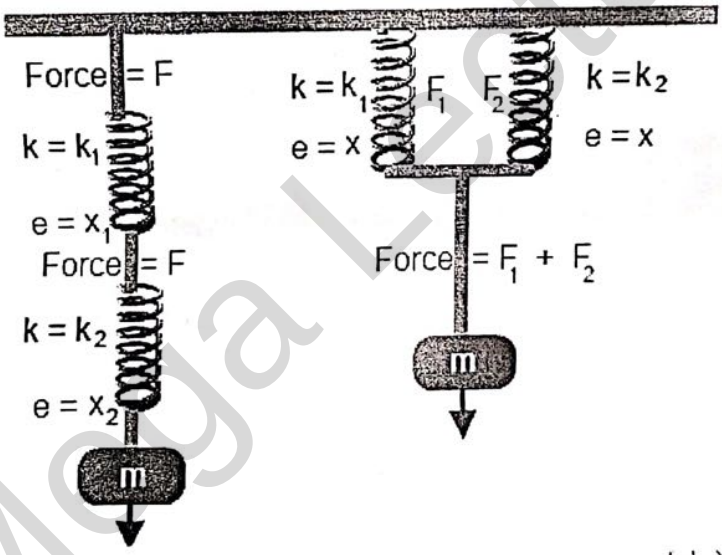
From the graph we notice the following:

1. In the elastic region, the graph is straight line, and "the extension is directly proportional to the stretching force.

   This relation is called: "Hooke's Law" In this region of proportionality, we get that: Extension = constant x Load



2. The end of the straight line is called "elastic limit".
3. In the region of the straight line, the spring returns to its original length when the load is removed.
4. Beyond the elastic limit, the relation is not proportional and the body become permanently stretched or deformed.



Two springs connected in series produce twice the extension, and two springs connected in parallel produce half the extension.

A spring with larger cross sectional area produces smaller extension for a particular force.

Hooke's Law

Extension is directly proportional to applied load within limit of proportionality.

$F \propto e$

$F = Ke$

Where $K = \frac{F}{e}$ is spring constant and measured in n/m. Spring constant is the force required by a material to show unit length extension.

Small value of k mean is soft material and large value of K mean is hard material.

Hooke's Law Graph